Quasi-persistent multiple mesoscale field-aligned currents in the duskside auroral oval

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Within a large-scale field-aligned current, whose latitudinal width is a few hundred kilometers in the ionosphere, smaller-scale current structures are often embedded. Previous studies have shown that a mesoscale upward field-aligned current with widths of order 10 km generally agree with auroral arcs. However, we still do not understand how this relation forms. In this study, using multispacecraft Swarm data and aurora data from a ground-based all-sky imager at Longyearbyen, Svalbard, we have examined mesoscale features of the field-aligned current and auroral arcs in the duskside auroral oval. We focused on the situation when the large-scale Region 1 current diminishes so that mesoscale features can stand out. Through the cross-correlation analysis of the magnetic perturbations observed by Swarm A and Swarm C, we took events in which the observed magnetic perturbations represent the spatial structure of multiple pairs of upward/downward mesoscale field-aligned currents, not Alfven wave. Conjugate observations between Swarm satellites and the all-sky imager have shown that auroral arcs actually occur in the region of the upward field-aligned current. The result of the analysis of the all-sky image data obtained before and after the conjunction event has shown that the auroral arcs have quasi-persistent features, and also indicated when the auroral arcs appear and disappear. From these results, we discuss how the mesoscale field-aligned current can form.

Keywords: Field-aligned current, Postnoon aurora, Swarm satellites

